by the 1,187 total expected deaths gives us an SMR of 1.13. This indicates that the overall 1991–95 death rate in Hertford County was higher than the rate in the 1993 North Carolina standard population, controlling for age. Multiplying the crude death rate in the standard population of 9.0 by 1.13 gives an indirectly standardized death rate for Hertford County of 10.2. To avoid differences between the observed and expected deaths due to changing (often declining) age-specific death rates over time, it is usually desirable to use a standard population that is close to the same year(s) as the data for the study population. Therefore, the 1993 (midpoint) North Carolina standard was used in this example.

✎ *Formula:*

Standardized mortality ratio (SMR) =
observed deaths ÷ expected deaths

Ex: SMR for Hertford County using information above =
1,336 ÷ 1,187 = 1.13

✎ *Formula:*

Indirectly standardized mortality rate =
crude death rate X SMR

Ex: Indirectly standardized mortality rate
for Hertford County =
9.0 X 1.13 = 10.2

Issues in Using Different Standard Populations

An age-adjusted death rate is a hypothetical index, designed to facilitate comparisons among populations, rather than a true measure of risk. An age-adjusted death rate (by the direct method) answers the question: What would the death rate in a study population be IF that population had the same age distribution as the standard population? So in theory any population distribution can be used as the standard; it is only a set of weights applied to the age-specific death rates. The choice of the standard population will not usually have a great effect on the **relative** levels of the age-adjusted rates that are being compared. But it is important to remember that age-adjusted death rates can be compared to each other only if they are adjusted to the same standard.

For many years the National Center for Health Statistics used the 1940 United States population as the standard for age-adjusting death rates. Converted to a population of one million with the same proportions at each age as in the 1940 population, this standard was presented as a "standard million." An advantage of consistently using this same standard population is that it promotes comparisons of age-adjusted death rates, especially in looking at trends over time from 1940 to later years. A disadvantage of using this standard is that the size of the adjusted rate is often much different from the size of the crude rate in the study population. This is

Comparison of the Direct and Indirect Methods of Adjustment

Direct Method	Indirect Method
• Use when the number of deaths in the study population is large enough to produce stable age-specific death rates.	• Use when the number of deaths in the study population is too small to calculate stable age specific death rates.
• Assumes a constant age distribution across all study populations.	• Maintains differences in age distributions between study populations.
• Rates from different study populations (e.g., counties in North Carolina) *can* all be directly compared to each other if adjusted using the same standard population.	• Rates from different study populations *cannot* be compared to each other since they are not based on a common age distribution.
	• Should compare the adjusted rate only with the rate of the standard population.